Fundamentals of Health Workflow Process Analysis and Redesign

Unit 10.2.2
Process Mapping
Diagramming Tools

This unit is from the Fundamentals of Health Workflow Process Analysis and Redesign curricular component. In two parts, this unit covers the background necessary for graphically representing processes and uses flowcharts and basic flowchart symbols to provide an introduction to graphical process representation, also called process diagramming. A separate unit covers complete symbol sets and conventions for different types of process diagrams.

Process Mapping Concepts

In the previous slides, we introduced process diagrams and reasons for creating a visual representation of a process. We also covered basic terminology for process diagramming. In this section, we will use these tools to explore process diagramming concepts.

A thorough understanding of these concepts will help the workflow analyst 1) choose the most appropriate diagram type, 2) make decisions about what to include in process diagrams, and 3) make decisions about the detail level at which to diagram the process.

Model: a representation of reality

"All models are wrong, some models are useful."

- George Box, industrial statistician

The most important thing to remember about process diagramming is that 1) a process diagram is a model; one representation of a process, 2) there are multiple, often many valid representations from which to choose, and 3) all models are wrong, i.e., a model is a representation of reality, as such, it can never encompass reality, only the part represented in the model.

For example, a toy remote control car represents the shape and maybe color of the make and model after which it is fashioned. The toy also moves on wheels like the real car. However, there are many ways in which the toy is not an exact replica of the actual car. For one it is smaller, secondly, the toy uses AA batteries for power. Another valid representation of the actual car would be a photograph or a set of engineering drawings.

A process diagram, like the toy car, picture, and engineering drawings, is only a model of the process that it represents. The analyst chooses the most appropriate diagram to represent the needed process aspects.

Different Models

Models represent different aspects and features of reality. Models can have differing levels of detail, and represent different perspectives. The best model is the one that communicates the needed information accurately.

To sell the watch at auction, the picture on the right may be the most appropriate. However, to show the inner mechanical parts, the picture on the left is probably best. Similarly, to look for potential explosive and other harmful objects, airport security uses x-rays to view the contents of luggage and packages rather than video images of the outside of the bags. Importantly, each perspective, inner workings and outward appearance is a model of the actual item, each represents different aspects of the item.

Different Purposes

Representation of reality

Blueprint

Models have different purposes. The features included, the level of detail, and the perspective reflect the purpose for which the model was created. The best model is the one that communicates the needed information accurately.

In his book, Guide to Health Informatics Enrico Coiera makes the distinction between models as abstractions of the real world versus models used as templates. For example, a photograph or painting is one model of a house. A set of drawings is a model of different aspects of the house, and is also used for a different purpose, i.e., as a blueprint for building the house. The blueprint (model) is used as a template from which more houses like the one it represents can be built. The abstraction – template distinction is based on how the model will be used.

Process Diagrams as Abstracts and Templates

- Some process diagrams are used to visualize the sequence of tasks and to identify tasks that are inefficient. This is a process diagram used as an abstraction
- Some process maps are used as templates, for example
  - as part of software development.
  - As part of process redesign.
- Process maps as abstracts and templates document and model the requirements and serve as “the holder of the knowledge”.

Some process diagrams are used to visualize the sequence of tasks and to identify tasks that are inefficient. This is a process diagram used as an abstraction, i.e., a representation of the process that shows the aspects that can help us identify unnecessary or wasteful steps.

Other process maps are used as templates, for example 1) as part of software development. Using increasing levels of detail and specificity, analyst work with users and developers to elicit and document requirements that can be used by computers to generate computer programs/ software to meet the requirements. Or 2) as part of process redesign. Process maps for changes or new processes can be used to guide the necessary workflow changes. In examples 1 and 2, the process maps document and model the requirements and serve as “the holder of the knowledge”. Process maps can be updated as needed. The knowledge resides in the model that everyone understands rather than in the computer code or in individual’s minds, that few people understand.

This unit provides methods to document and preserve process knowledge.

Physical and Mental Process Steps

	Physical Steps	Mental Steps	Information Processing
Human	X	X	Physical
			Mental
Machine	X		Physical

A process is composed of tasks accomplished by both human and machine. From cognitive science, we know that humans can perform both physical and mental steps or tasks. Further, we know that today, machines can only perform physical tasks, i.e., machines, even computers can not think like a human can.

However, today we commonly use computers for information processing tasks. While the computer performs the physical manipulations on the information, interpretation and thinking remain the role of the human. Thus, humans interact with computers both in physical work flow and in information flow. Further, we make machines perform human-like tasks by reducing human thought into a set of conditions that a machine can recognize and a set of instructions that a machine can carry out under the conditions.

Process diagramming is complicated by the intertwined nature of humans and computers in information processing. One approach to dealing with this complexity is to use different representations of processes, some that concentrate on physical steps, others that concentrate of information flow, others that depict information content, and others that represent some aspects of thinking or decisions (sometimes called flow control), i.e., how different paths in the process are chosen.

Aspects of Work and Information Processes that we Diagram

- Context
- Process steps
- Information flow
- Information content
- Information transformation
- Step sequence, control, and status
- Who or what performs the process steps

Since the 1920's[6] and maybe earlier, flowchart-like diagrams have been used as representations of processes. This is a vast oversimplification, though.

The fact is that there are many different aspects of both work and information processes that we may be interested in, for example:

•the context in which the process operates,

•Process steps/tasks

•Information flow

•the information content needed for the process,

•how the information are altered through the process,

•the sequence and other control of steps/tasks

•the roles involved in the process,

Diagramming a Process

First: identify the purpose for which the diagram will be used

Second:

- get clear about which process aspects need to be visualized, choose diagram type
- decide the required detail level

Third: pick appropriate notation

Visually depicting a process first and foremost involves identifying the purpose of the process diagram(s), abstraction or template, i.e., why are the diagram(s) needed. Then identifying the aspect(s) of the process that we are interested in, and choosing a diagram or set of diagrams that emphasizes those aspects of interest and de-emphasizes, or completely eliminates (from view) the others. And the necessary detail level. Then third, pick an appropriate style and notation to use.

Process Diagramming Methods

In the previous slides, we established the foundation for using symbols to pictorially represent and communicate meaning. Additionally, we established the purpose and value of process maps and the use of process maps in developing clinical workflow models.

Now, we will look at the different diagramming methods for developing these pictorial representations of processes in the health care settings. Throughout the last century, different formalisms, each with it's own diagram types and notation have arisen. There is considerable overlap between the formalisms. Some have fallen by the way-side and others remain in use. Some have become international standards, while others exist in textbooks and articles. In this section, we present major formalisms in use today, and the process aspects that the formalism covers.

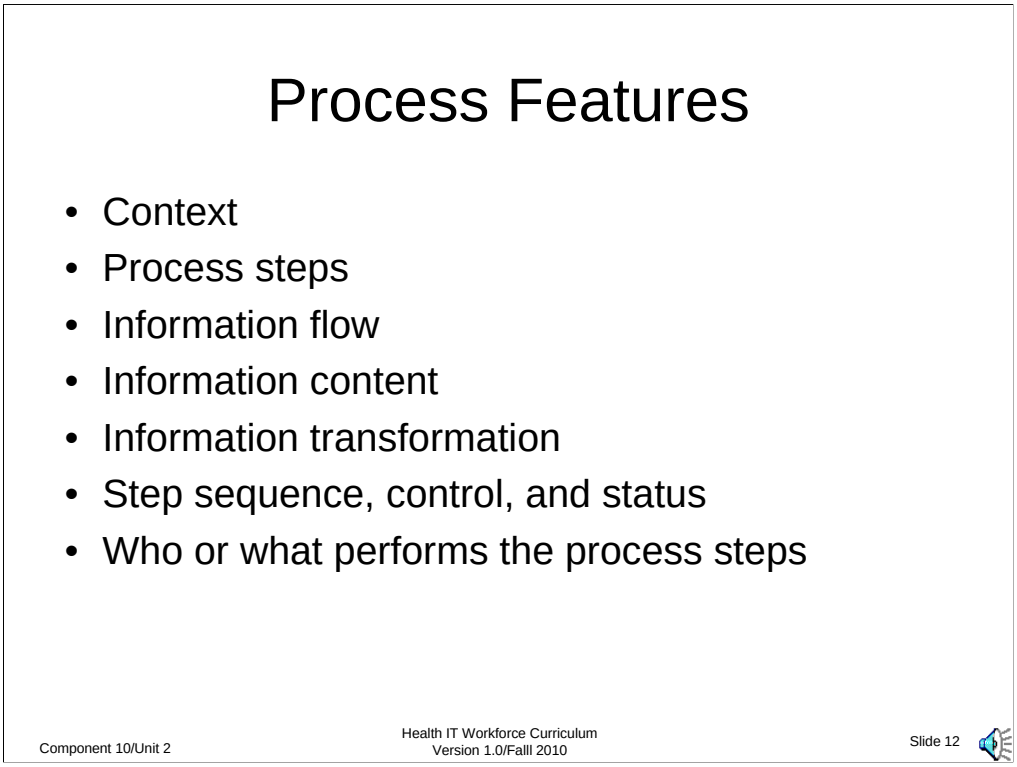
So Many to Choose From

- Several methods and notations for diagramming processes exist. Main ones include:
  - ISO 5807 Flow Charting
  - Yourdon (including Yourdon-code, and Yourdon-DeMarco)
  - Gane-Sarson
  - Unified Modeling Language (UML)
  - E-R diagram
- They differ in notation and in the process aspects covered.

There are several methods and notations for diagramming or mapping the clinical workflow processes, including:

ISO 5807 information processing diagrams, the same symbols used for Flow Charting, Yourdon notation for data flow diagrams, Gane-Sarson notation for data flow diagrams, Unified Modeling Language (UML) that represents several different aspects of processes, and Entity relationship (E-R) diagrams that concentrate solely on information content. These methods differ in notation used, and most importantly, the aspects of processes and information flow that each is designed to cover.

In this section, we will review the process aspects that each notation covers and show an example of each type of diagram.



The process aspects to be featured will determine the type of diagram to be used, i.e. the diagram that best represents the process aspects that you are interested in. The are six important process aspects are:

Context
Process steps
Information flow
Information content
Information transformation
Sequence and other control
Who or what role performs the step

The following table indicates which process aspects are covered by the notations / diagramming methods.

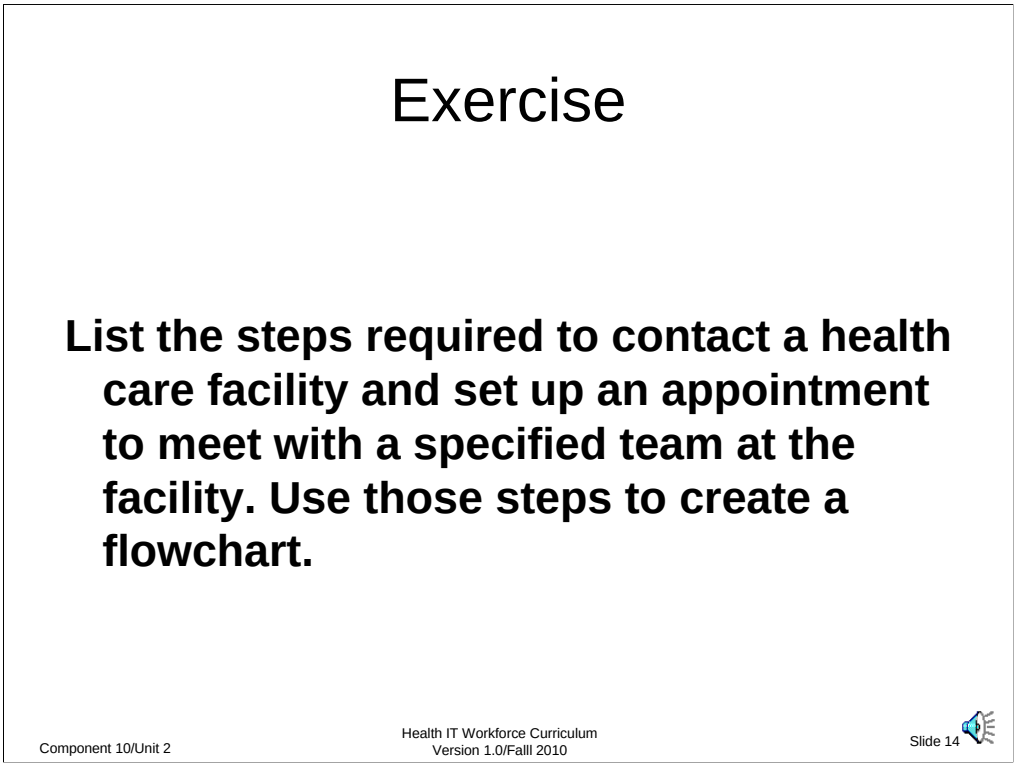
Note: The health care setting in which you work may have standardized on one particular notation/method for their process representation. Further, healthcare facilities may have participated in quality improvement or software development efforts, in which case, there may be existing process diagrams that may be of use to you. So, while you may prefer a particular method and can select that method of use in this course, it is important to be aware the major notations/methodologies, and to understand the basic uses and notation of each.

Methods for Diagramming Processes

Process Aspects	ISO 5807	Yourdon	Gane-Sarson	UML	E-R diagram
Context		X	X	X	
Process steps	X			X	
Data flow steps	X	X	X	X	
Information content		text	text	X	X
Data transformation	X	X	X	X	
Flow control and state	X		text	X	
Roles involved	X			X	

The remainder of this unit covers five notations that are commonly used to diagram processes: ISO 5807, Yourdon, Gane-Sarson, UML, and E-R diagrams. ISO 5807 can be used to represent process steps and their sequence and control, as well as information transformation and roles involved in the process. Yourdon represents context, process steps, and information transformation. Gane-Sarson represents the latter two process aspects. Unified Modeling language, developed a few decades after and heavily influenced by the earlier methods was designed to represent all but the Yourdon-style context diagram. The Entity-relationship diagram is designed to represent only information content.

Material in a separate unit covers each of these five methodologies.



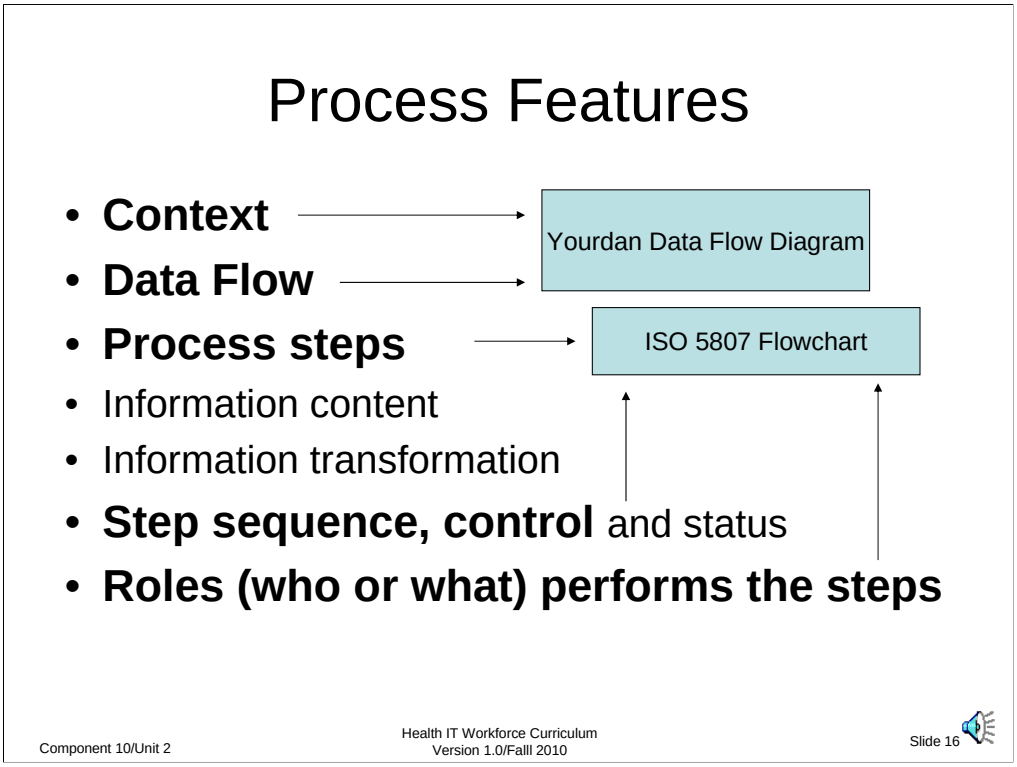
Eventually, you will need to contact a health care facility and set up an appointment to meet with a team to diagram the workflow process in that facility. Let's pause and work an example. After these instructions, pause the slides. Think through and list the steps required to contact the facility and set up the meeting. Using the basic flowchart symbols covered in part 1 of this presentation, create a simple process flowchart.

We suggest using MS Word or MS powerpoint to create your diagram. To do this, from the view menu, select toolbars. From the toolbar list, select drawing. Then select the auto shapes menu. Here you will find the auto shapes and connectors needed to draw your process flowchart. Demonstrations are available on the Microsoft website and may be listed with your course materials.

Pause the slides and do the exercise now.

Recommended Diagrams for Health care facility workflow process and redesign

For the work in this course there are Recommended Diagrams for Health care facility workflow process and redesign.



Not all of the process aspects noted earlier are critical for process analysis and redesign work covered here. For the health care workflow process analysis and redesign we recommend the following:

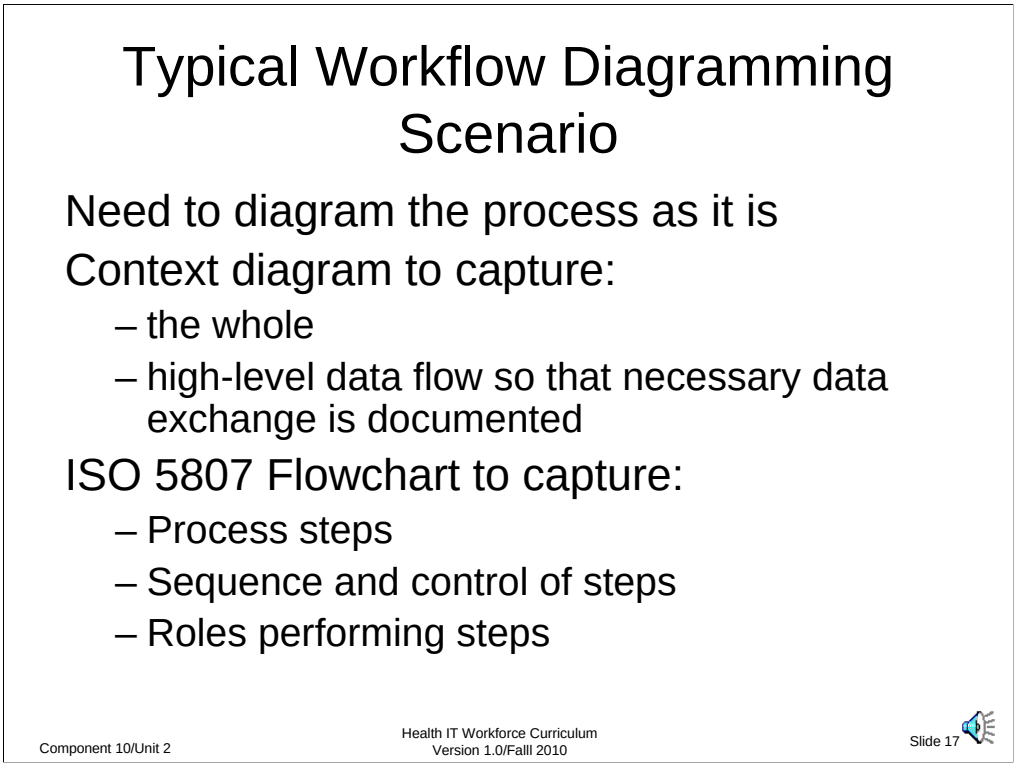
Yourdan – Data Flow Diagrams

ISO 5807/Flowcharts – Process steps, Step sequence and other control diagrams, as well as Roles performing the steps

Yourdan Data Flow Diagrams and ISO 5807 Flowcharts are covered in Unit 10.3. We recommend that you review these two sections carefully.

The primary slides that we have just reviewed provided the concepts and background for these diagrams and simple examples. In unit 3, we provide more detailed instructions on how to create and use the diagrams. We also provide additional symbols that are needed to diagram more complex processes.

Unit 10.3 covers the necessary diagrams and provide examples and practice for creating the Yourdon Data Flow Diagrams and ISO 5807 Flowcharts. Examples of the other 3 related diagrams that the analyst is likely to encounter are also covered in Unit 3; the goal is to teach students how to read and understand these other diagrams rather than how to create them.



The goal of workflow analysis and process redesign is to represent aspects of the process that help the analyst and healthcare facility staff identify areas where the process can be improved.

The diagrams recommended here met this need by concentrating on process steps data flow, roles, and visualizing the whole. There are other process aspects that are not critical to this analysis and thus will not be considered.

Other efforts where these methods have been used to successfully analyze and redesign health care processes include the Public Health Institute's Business Process Analysis and Redesign program to improve the performance of the U. S. public health system.[7] We strongly recommend that you review this reference.

Cabarrus Health Alliance

- Robert Woods Johnson Foundation grant
- Public Health Informatics Institute
- Cabarrus Health Alliance (CBA) process analysis and improvement through information technology introduction.
- Excellent case study of using the methods[7] described above to analyze and evaluate improvements in process and informatics for their Public Health Department.
- http://www.cabarrushealth.org/CommonGround/

The Robert Woods Johnson Foundation provided a grant to the Public Health Informatics Institute to improve the performance of the public health system.

As part of this effort the Cabarrus Health Alliance (CBA) analyzed the process improvement through information technology introduction.

This effort provides an excellent case study of using the methods described above to analyze and evaluate improvements in process and informatics for their Public Health Department.[7]

Please review this website and the process diagrams included.

Summary

At this point you should be able to

- Explain two ways process diagrams are used as models
- Distinguish the physical steps from information flow in a healthcare process involving an EHR
- Choose an appropriate process diagram to model given aspects of a process

After completion of this unit, you should be able to:

1. Describe the value of process diagrams
2. List the process steps from a healthcare scenario
3. Describe basic flowchart symbols
4. Working from a workflow process chart consisting of basic flow charting symbols, you should be able to list the information generated or used in the process and the sequence of workflow steps.
5. Read a scenario and using basic flowchart symbols represent the process steps and their sequence
6. Explain two ways process diagrams are used as models
7. Distinguish the physical steps from information flow in a healthcare process involving an EHR
8. Choose an appropriate process diagram to model given aspects of a process

References

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These references were used in the slides for this unit.